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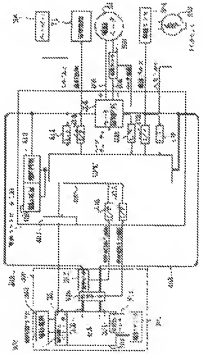
(54) CONTROL SYSTEM OF HYBRID POWER-ASSISTED BICYCLE

(57)Abstract:
PROBLEM TO BE SOLVED: To effectively combine the electric power corresponding to the operating condition of an electric vehicle, and to effectively function a fuel cell.
SOLUTION: A hybrid electric vehicle having a power source which drives drive wheels based on a plurality of power sources, includes at least an electric motor 21 for driving the drive wheels and at least a fuel cell 30 for supplying the power to this electric motor 21, and controls the output of the electric motor 21. The vehicle comprises a temperature detecting means for detecting the temperature of the fuel cell 30, a control means for controlling the required output of the electric motor 21 based on the temperature of the fuel cell 30, and a



residual fuel quantity display means for displaying the residual fuel quantity by calculating the fuel consumption.

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]While driving a driving wheel characterized by comprising the following based on two or more sources of power, A hybrid type electric motor which carries a power supply which drives said driving wheel, which supplies electric power to an electric motor and this electric motor at least, and which contains a fuel cell at least, and controlled an output of said electric motor.
A temperature detecting means which detects temperature of said fuel cell.
A control means which controls required power of said electric motor based on temperature of said fuel cell.

[Claim 2]The 1st drive system characterized by comprising the following that drives a driving wheel with the 1st power, The 2nd power system that drives said driving wheel with the 2nd power by an electric motor, A control system of a hybrid type electric motor which carries a power supply which supplies electric power to said electric motor, and which contains a fuel cell at least, starts said power supply corresponding to change of the 1st drive by said 1st drive system, and controls an output of an electric motor of said 2nd power system.
A temperature detecting means which detects temperature of said fuel cell.
A control means which controls required power of said electric motor based on temperature of said fuel cell.

[Claim 3]A control system of the hybrid type electric motor according to claim 1 or 2 when said control means is [temperature of said fuel cell] below prescribed temperature, wherein it controls required power of said electric motor not to make electric power more than permission output from said fuel cell.
[Claim 4]The 1st drive system characterized by comprising the following that drives a driving

wheel with the 1st power, The 2nd power system that drives said driving wheel with the 2nd power by an electric motor, A control system of a hybrid type electric motor which carries a power supply which supplies electric power to said electric motor, and which contains a fuel cell at least, starts said power supply corresponding to change of the 1st drive by said 1st drive system, and controls an output of an electric motor of said 2nd power system.
An operational state detecting means which detects operational status of said hybrid type electric motor.
A control means which controls required power of said electric motor based on operational status.

[Claim 5]The 1st drive system characterized by comprising the following that drives a driving wheel with the 1st power, The 2nd power system that drives said driving wheel with the 2nd power by an electric motor, A control system of a hybrid type electric motor which carries a power supply which supplies electric power to said electric motor, and which contains a fuel cell at least, starts said power supply corresponding to change of the 1st drive by said 1st drive system, and controls an output of an electric motor of said 2nd power system.
An output power detection means to detect output power of said fuel cell.
A control means which computes fuel consumption from current, voltage characteristic data, and efficiency data which were beforehand memorized based on said output power.
A remaining fuel displaying means which displays remaining fuel from calculation of this fuel consumption.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the control system of the hybrid type electric motor which carries a fuel cell at least and was made to **** the output of said electric motor which drives said driving wheel and which supplies electric power to an electric motor and this electric motor at least while driving a driving wheel based on two or more sources of power.

[0002]

[Description of the Prior Art]For example, although there is a battery-assisted bicycle which makes human power the 1st power as one of the hybrid type electric motors, generally, the source of power is a rechargeable battery, and if a rechargeable battery is charged via a battery charger from a home power supply before a run and the capacity of a rechargeable battery is lost, it will use it, charging again.

[0003]In such a battery-assisted bicycle, since charge takes several hours and a run becomes impossible in the meantime, hydrogen Bon ** or a reformer, and a fuel cell are carried in JP,8-119180,A, and there are some which drive an electric motor in it, for example.

[0004]A hybrid type electric motor has the indication of what has rechargeable batteries, such as a fuel cell and a battery, as the source of power, and the thing which carries a reformer as a hydrogen supply system to a fuel cell further. In what carries a reformer, the temperature of a reforming catalyst part is detected and there is an indication of what carries out reforming catalyst part heating according to temperature.

[0005]

[Problem(s) to be Solved by the Invention]By the way, to the conventional thing, the indication of how to control power generation of a fuel cell corresponding to a run of a hybrid type electric motor is absolutely none, and. There is no indication of combining the 2nd power effectively to the 1st power corresponding to the traveling condition of a hybrid type electric motor, and

making it operate a fuel cell effectively etc.

[0006]The reactivity of hydrogen and oxygen is blunt, and in using a fuel cell especially, if the electric power more than predetermined is taken out, it will do damage not only to fuel efficiency but to the fuel cell itself, until a fuel cell goes up to optimal temperature as the characteristic of a fuel cell. Even when an electric output has not been carried out, in order to maintain the power generation operation of a fuel cell body, there is a problem of fuel being consumed continuously.

[0007]An object of this invention is to provide the control system of the hybrid type electric motor which it was made in view of this point, and electromotive force is effectively combined corresponding to the operational status of a hybrid type electric motor, and can operate a fuel cell effectively.

[0008]

[Means for Solving the Problem]In order to solve said technical problem and to attain the purpose, this invention was constituted as follows.

[0009]While the invention according to claim 1 drives "driving wheel based on two or more sources of power, In a hybrid type electric motor which carries a power supply which drives said driving wheel, which supplies electric power to an electric motor and this electric motor at least, and which contains a fuel cell at least, and controlled an output of said electric motor, Control system of a hybrid type electric motor provided with a temperature detecting means which detects temperature of said fuel cell, and a control means which controls required power of said electric motor based on temperature of said fuel cell. It is ".

[0010]According to this invention according to claim 1, it is possible to detect temperature of a fuel cell, and to combine electromotive force effectively corresponding to operational status of a hybrid type electric motor by controlling required power of an electric motor based on temperature of a fuel cell, and to operate a fuel cell effectively.

[0011]The 1st drive system in which the invention according to claim 2 drives "driving wheel with the 1st power, The 2nd power system that drives said driving wheel with the 2nd power by an electric motor, A power supply which supplies electric power to said electric motor and which contains a fuel cell at least is carried, In a control system of a hybrid type electric motor which starts said power supply corresponding to change of the 1st drive by said 1st drive system, and controls an output of an electric motor of said 2nd power system, Control system of a hybrid type electric motor provided with a temperature detecting means which detects temperature of said fuel cell, and a control means which controls required power of said electric motor based on temperature of said fuel cell. It is ".

[0012]According to this invention according to claim 2, it is possible to detect temperature of a fuel cell, and to combine electromotive force effectively corresponding to operational status of a hybrid type electric motor by controlling required power of an electric motor of the 2nd power

system based on temperature of a fuel cell, and to operate a fuel cell effectively

[0013]The invention according to claim 3 the "aforementioned control means, Control system of the hybrid type electric motor according to claim 1 or 2 controlling required power of said electric motor not to make electric power more than permission output from said fuel cell when temperature of said fuel cell is below prescribed temperature. It is "

[0014]By controlling required power of an electric motor not to make electric power more than permission output from a fuel cell, and suppressing an output at the time of low temperature of a fuel cell, when temperature of a fuel cell is below prescribed temperature according to this invention according to claim 3, Degradation of a fuel cell can be prevented and fuel consumption efficiency can be raised.

[0015]The 1st drive system in which the invention according to claim 4 drives "driving wheel with the 1st power, The 2nd power system that drives said driving wheel with the 2nd power by an electric motor, A power supply which supplies electric power to said electric motor and which contains a fuel cell at least is carried, In a control system of a hybrid type electric motor which starts said power supply corresponding to change of the 1st drive by said 1st drive system, and controls an output of an electric motor of said 2nd power system, Control system of a hybrid type electric motor provided with an operational state detecting means which detects operational status of said hybrid type electric motor, and a control means which controls required power of said electric motor based on operational status. It is ".

[0016]According to this invention according to claim 4, operational status of a hybrid type electric motor is detected, Based on operational status, control required power of an electric motor of the 2nd power system, and For example, a state which does not need electric outputs, such as waiting for a signal, and a long downward slope, Or unnecessary power consumption, such as stopping a fuel cell for fuel economy for a reason for legal restrictions which do not carry out an electric output above regulation speed, can be prevented, and it becomes saving of fuel of a fuel cell.

[0017]The 1st drive system in which the invention according to claim 5 drives "driving wheel with the 1st power, The 2nd power system that drives said driving wheel with the 2nd power by an electric motor, A power supply which supplies electric power to said electric motor and which contains a fuel cell at least is carried, In a control system of a hybrid type electric motor which starts said power supply corresponding to change of the 1st drive by said 1st drive system, and controls an output of an electric motor of said 2nd power system, An output power detection means to detect output power of said fuel cell, and a control means which computes fuel consumption from current, voltage characteristic data, and efficiency data which were beforehand memorized based on said output power, Control system of a hybrid type electric motor provided with a remaining fuel displaying means which displays remaining fuel from calculation of this fuel consumption. It is ".

[0018]According to this invention according to claim 5, output power of a fuel cell is detected, Without using a flow instrument for computing fuel consumption, displaying remaining fuel from calculation of this fuel consumption, and detecting remaining fuel from current, voltage characteristic data, and efficiency data which were beforehand memorized based on this output power, An improvement of weight and cost can be aimed at by detecting remaining fuel by calculation.

[0019]

[Embodiment of the Invention]Below, the embodiment of the control system of the hybrid type electric motor of this invention is described based on an accompanying drawing. It is a figure showing the state where drawing 1 removed the side view of the hybrid type electric motor, and drawing 2 removed the power supply of the hybrid type electric motor.

[0020]By this embodiment, human power used as the 1st power is made into main power as a hybrid type electric motor, and the bicycle 1 with electric assistance which makes auxiliary power the motor output used as the 2nd power is shown. This bicycle 1 with electric assistance has the car body frame 2, and is inserted in in the head tube 4 located ahead [of the main pipe 3 which constitutes this car body frame 2 / body], enabling free rotation of the handle stem 5. The handle 6 is formed in the upper bed part of the handle stem 5, and the front fork 7 is formed in the lower end part of the handle stem 5. The main switch SW is formed in the handle 6, and the control system of a hybrid type electric motor operates with this main switch SW for it.

[0021]The front wheel 8 is supported pivotally by the lower end of the front fork 7, enabling free rotation. The speed sensor S51 is formed in the shank of the front wheel 8 of the front fork 7. From the head tube 4, the main pipe 3 had extended in the slanting lower part toward body back, was further crooked in the lower part, and is prolonged back. From the back end of this main pipe 3, the seat tube 9 is set up by the slanting upper part toward body back. The saddle 11 is supported by the upper bed part of the seat tube 9 via the seat pillar 10, and height adjustment is possible at operation of the height adjustment handle 60.

[0022]It is the abbreviated central lower part of the body, and the power unit 20 is hung by the joining segment of the main pipe 3 and the seat tube 9 via the bracket 19. The power unit 20 puts side by side the main drive system by a crew member's treading strength, and the auxiliary power system by the electric motor 21, and is constituted, The crankshaft 12 is supported movably by this, enabling free rotation, the crank 13 is attached to the both the right and left ends of the crankshaft 12, and the pedal 14 is supported pivotally by the end of each crank 13.

[0023]It is a time of the main switch SW being an ON state, and only when a crew member's treading strength is applied to the crankshaft 12 from the pedal 14, the electric motor 21 is rotated and the power from the electric motor 21 is told to the crankshaft 12. That is, when the

pedal 14 is stepped on, in addition to the treading strength, the running torque from the electric motor 21 will be given to the crankshaft 12. The output of this electric motor 21 is controlled to abbreviated-be proportional to the treading strength applied to the pedal 14, and this treading strength is detected by the torque sensor S52 in the power unit 20.

[0024]From the bracket 19, the chain stay 25 of the right-and-left couple is installed toward body back, and the rear end part of the chain stay 25 is connected with the lower end of the seat stay 22 of the right-and-left couple which extends in a slanting lower part toward the upper bed empty vehicle object back of the seat tube 9. The rear wheel 23 is supported pivotally by the connecting part of the chain stay 25 and the seat stay 22, enabling free rotation. In the seat stay 22, the rear wheel locking device 24 for theft prevention is formed, and rotation of the rear wheel 23 is locked with the rear wheel locking device 24.

[0025]It has the fuel cell 30 which is a power supply which supplies electric power between the seat tube 9 and the rear wheel 23 at the electric motor 21 above the power unit 20 removable. The fuel cell receptacle 34 is formed in the bracket 19, and the fuel cell locking device 35 is formed in this fuel cell receptacle 34. Where the fuel cell receptacle 34 is equipped with the fuel cell 30, the lock pin 51 engages with the engaging recess 32d of the fuel cell 30, and is locked.

[0026]The body side plug 63 is being fixed to the pars basilaris ossis occipitalis of the fuel cell receptacle 34. The fuel cell 30 has the connectable electric power extraction part 70 electrically to the body side plug 63, where the body is equipped. The fuel cell 30 is it being removable, and this electric power extraction part's 70 being formed in the lower part of the fuel cell 30 along with the upper guide 42 and the lower guide 37, and equipping with the fuel cell 30 along with the upper guide 42 and the lower guide 37, and the body side plug 63 is electrically connected with the electric power extraction part 70.

[0027]The upper guide 42 is being fixed to the seat tube 9. As for the lower guide 37, the lower part 37a is fixed to the fuel cell receptacle 34, and the upper part 37b is being fixed to the rear fender 28 via the locking tool 40.

[0028]The bracket 53 of the saddle 11 is rotatable about the holding pin 54 to the bracket 52 fixed to the upper part of the seat pillar 10 at the fulcrum. The lock pin 55 is being fixed to the bracket 52 of the seat pillar 10. The holding pin 57 is formed in the locking lever 56 by the bracket 53 of the saddle 11 rotatable at a fulcrum. This locking lever 56 is energized by the spring 58 so that the claw part 56a may engage with the lock pin 55. The saddle 11 can be moved to a front position by rotating the locking lever 56 by hand and removing the claw part 56a from the lock pin 55, and the fuel cell 30 can be detached and attached into the body in this state.

[0029]The handle 6 is equipped with the display 71, the remaining fuel of the fuel cell 30, etc. are displayed on it with this display 71, and it enables it to tell a driver about the state of the

fuel cell 30.

[0030]Next, the composition of the fuel cell 30 is explained based on drawing 3. Drawing 3 is a block diagram showing the composition of a fuel cell.

[0031]The fuel cell 30 of this embodiment is a cartridge-type, is stored by the cartridge 300 and constitutes the fuel cell unit. In the cartridge 300 of a fuel cell unit, the fuel tank 301 is arranged at the lower part, the fuel cell body 302, i.e., a cell, is arranged in the center section, and the fuel cell controller 303 is arranged in the upper part. It is a fuel cell unit's being a gestalt which stores the cell 302 as basic constitution of the fuel cell 30, the fuel cell controller 303, and the fuel tank 301 to the cartridge 300 of one box, arranging a component in a column, and considering it as long and slender shape, It can be made the shape which is easy to include also in narrow vehicles.

[0032]Since the fuel cell 30 of a cartridge-type becomes the weight of several kilograms on the whole, it tends to treat the way which is stood downward and with which load is equipped, and, in a direction narrow in unit shape, the flexibility in a mounting surface goes up it. Therefore, when fuel is hydrogen, as a layout at this time, from the bottom, it is considered as the order of the fuel tank 301, the cell 302, and the fuel cell controller 303, and a component unit is arranged in a column. Since heat occurs and the upper part gets warm easily by an air convection with power generation from the cell 302, in order to avoid heating of the fuel tank 301, the fuel tank 301 is arranged in the lower part of the cell 302.

[0033]Thus, since those upper parts will also be heated by an air convection if the cell 302 and fuel cell controller 303 grade may be heated by the contingency, When fuel is a fluid, the fuel tank 301 is arranged to the cell 302 up side, and it may be made arrange the fuel tank 301 to the cell 302 and fuel cell controller 303 down side so that the fuel tank 301 may not be heated superfluously, but to supply fuel by a natural fall.

[0034]That is, since fuel will carry out a natural fall to the cell 302 with gravity if fuel arranges the fuel tank 301 in the upper part of the cell 302 in the case of a fluid etc., a component like a pumping pump becomes unnecessary and it becomes advantageous in respect of cost, a payload, etc. In this case, in order to prevent the fuel tank 301 from being heated by the air convection by cell waste heat, cell storage space provides the fuel tank storage space of the isolated another room, and attaches thermal insulation to a septum. In order to prevent thermal insulation from igniting with hotter waste heat etc., fuel tank storage space is further covered with an incombustible material.

[0035]The fuel cell 30 is equipped with the auxiliary battery 340. For cell starting, the auxiliary battery 340 starts the fuel cell controller 303 by the main power supply circuit 341, and it makes the air pump 321 drive, or the fuel valve 316 is opened and closed via the actuator 317, or it serves as a power supply to the fuel cell controller 303. This auxiliary battery 340 charges a part for the consumed electric power in response to supply after starting of the cell 302 from

the cell 302.

[0036]The fuel cell controller 303 is equipped with the nonvolatile memory 342, and remaining fuel data etc. are memorized by the nonvolatile memory 342. The remaining fuel indicator 350 is formed in the upper part of the fuel cell 30, and the fuel of the fuel tank 301 is displayed on it by LED. Thus, the fuel cell controller 303 makes a remaining fuel display make it serve a double purpose, and it arranges the remaining fuel indicator 350 at the topmost part so that it may be easy to recognize visually from the upper part.

[0037]The fuel tank 301 is arranged in the fuel tank storing chamber 304a formed with the fuel tank containing case 304, This fuel tank storing chamber 304a is open for free passage with the wind hole 306 formed in the cartridge 300 via the introduction duct 305, and is open for free passage with the exhaust port 308 formed in the cartridge 300 via the exhaust duct 307.

[0038]The running wind which it was located in the before [a vehicle traveling direction] side, and the exhaust port 308 was located in the before [a vehicle traveling direction] side, and was taken in from the wind hole 306 the wind hole 306, He flows through the fuel tank storing chamber 304a via the introduction duct 305, and is trying for the fuel temperature of the fuel tank 301 to turn into outdoor air temperature by being exhausted from the exhaust port 308 via the exhaust duct 307. In order to bring forward the gas diffusion to the inside of the atmosphere at the time of fuel gas leakage, the fuel tank containing case 304 was made into the another room structure intercepted by the septum, and the wind hole 306 and the exhaust port 308 which are fresh air inlets with the open air are established. Thus, if fuel tank storage space and cell storage space are isolated by the septum 311 and a wind hole is provided in the upper part of the septum 311 in a direction of movement and its tail end, respectively, hydrogen will be back spread in the atmosphere smoothly by the characteristic lighter than air and the flow of a running wind.

[0039]At the time of leakage, since it is generally lighter than air, fuel gas is making the wall of the fuel tank storing chamber 304a incline toward back, uniting, and arranging the exhaust port 308 in a position higher than the wind hole 306, and is carried out that it is easy to diffuse gas back so that it may be spread promptly back.

[0040]Thus, in the case of gases, such as hydrogen gas, supposing the gas leakage from the fuel tank 301, a fuel tank storage ventilates well and the fuel of the fuel tank 301 leads to the open air. If the wall of the septum 311 is made to incline toward back and it provides in it with the back exhaust port 308 at a high position, the gas which leaked will become also in the state of a vehicle interdiction that it is easy to be spread back.

[0041]The thermal insulation 309a and the incombustible material 309b are formed in the fuel tank containing case 304. By covering the fuel tank storing chamber 304a with the thermal insulation 309a, it can carry out as [heat / the fuel tank 301 / carelessly] with the waste heat of the cell 302, etc. By covering the fuel tank storing chamber 304a with the incombustible

material 309b, by the cell 302, the short circuit of the fuel cell controller 303, etc., even if the circumference heats, it is carrying out as [be / it / less than the fuel tank 301]. It dissociated by the septum 311 and the fuel tank storing chamber 304a and the cell storing chamber 310 have reduced the thermal effect to the fuel tank 301.

[0042]The fuel tank mounting detecting switch S61, the remaining fuel reset switch S62, and the fuel leakage detector 312 are arranged at the fuel tank containing case 304. The fuel tank mounting detecting switch S61 detects attachment/removal of the fuel tank 301, and sends this information to the fuel cell controller 303. In the fuel cell controller 303, supply of fuel is enabled from the fuel tank 301 by attachment detection at the cell 302, by removal detection, the actuator 317 of the fuel valve 316 is operated and the fuel valve 316 closes.

[0043]The remaining fuel reset switch S62 operates at the time of exchange of the fuel tank 301, sends remaining fuel reset information to the fuel cell controller 303, and resets the remaining fuel of nonvolatile MOMERI 342 of the fuel cell controller 303.

[0044]From the fuel tank 301, the fuel leakage detector 312 (if it is hydrogen gas hydrogen gas sensor) is located in the downstream, detects fuel leakage, sends fuel leakage information to the fuel cell controller 303, and the fuel cell controller 303 closes the fuel valve 316, and it suspends power generation.

[0045]The fuel tank mounting-and-fixing part 313 is formed in the fuel tank storing chamber 304, and the exchangeable fuel tank 301 is fixed to it. The fuel output port 314 is established in this fuel tank mounting-and-fixing part 313, and the fuel taken out from this fuel output port 314 is supplied to the cell 302 via the fuel supply piping 315.

[0046]The fuel valve 316 is formed in the fuel supply piping 315, and this fuel valve 316 is opened and closed with the actuator 317 to it. The actuator 317 opens and closes the fuel valve 316 based on the instructions from the fuel cell controller 303, and controls the fuel supplied to the cell 302. if opening and closing of the fuel valve 316 are automated by the fuel cell controller 303 and the actuator 317, the fuel valve 316 is opened in operation in the normal state and fuel is exhausted, the fuel tank 301 will be removed or a certain failure will close the fuel valve 316 in a use unexpected situation.

[0047]The cooling-wind-blows feed port 318 is opened for free passage and established in the before [a vehicle traveling direction] side at the cell storing chamber 310, and the cooling-wind-blows exhaust port 319 is opened for free passage and established in the cartridge 300 at the cell storing chamber 310 at the backside [the vehicle traveling direction]. In the cell storing chamber 310, the cell cooling fan 320 is arranged and this cell cooling fan 320 is driven by the fuel cell controller 303. Cooling wind blows are compulsorily taken in by the drive of this cell cooling fan 320 from the cooling-wind-blows feed port 318 to the cell storing chamber 310, the cell 302 is cooled, it is exhausted from the cooling-wind-blows exhaust port 319, and the running wind of vehicles is used for cell cooling.

[0048]In the cell storing chamber 310, the air pump 321 is arranged and this air pump 321 is driven by the fuel cell controller 303. Air is supplied to the cell 302 by the drive of this air pump 321 via the air supply piping 322.

[0049]If the composition of the cell 302 of the fuel cell 30 is explained briefly, hydrogen used as fuel is supplied to a cathode pole (negative pole) from the fuel tank 301, and from the air pump 321, air will be ***(ed) as an oxidizer to the anode pole (anode), and it will generate electricity by performing electrochemical reaction by a catalyst. A polymers ion-exchange membrane is infixed between two electrodes. Water is supplied in order to get wet in order to secure the permeability of a hydrogen ion to this ion-exchange membrane and to make it move to it smoothly, and to change into a state. The cell 302 is constituted by making such an electrode pair into a unit, and the fuel cell of the prescribed output which totaled the electromotive force of each cell 302 combining the cell 302 of two or more sheets is formed. Generation of heat accompanying the electromotive force reaction of the cell 302 passes air on the periphery of the cell 302, and cools on it.

[0050]For example by using methanol as primary fuel, hydrogen used as fuel mixes this with water, and heating evaporation is carried out, The catalytic reaction of a reformer decomposes into hydrogen and carbon dioxide, and after reducing the concentration of the carbon monoxide by which it was generated in the minute amount with the reformer via a shift converter, a selective oxidation reactor, etc., this hydrogen gas is supplied to the anode electrode of the cell 302 of a fuel cell. Or direct supply of the hydrogen gas may be carried out from a cylinder.

[0051]The electric power of the cell 302 is taken out with the power line 330,331 to the electric power extraction part 70, and the diode D1 of prevention of backflow is connected to the power line 330. In the cell 302, the cell temperature detection sensor S11 is formed, this cell temperature detection sensor S11 detects cell temperature in it, and it sends to the fuel cell controller 303.

[0052]The external communication part 351 is formed in the fuel cell controller 303. In this external communication part 351, the ON/OFF information on the main switch SW, external abnormality information, and a fuel cell controller seizing signal, A fuel cell control signal etc. are received from the external communication part 401 of the vehicle controller 400, and, on the other hand, remaining fuel information, remaining fuel reset switch information, fuel-cell-temperature information, and the abnormality information of the fuel cell 30 are transmitted to the external communication part 401 of the vehicle controller 400 by the external communication part 351.

[0053]Thus, the fuel cell controller 303 has a function which communicates with the exterior, and serves as starting of the fuel cell controller 303 and the switch of OFF. A power supply is turned OFF after closing the fuel valve 316 to the main power supply circuit 341, when there is

no communication from the outside.

[0054]By arrival of a data signal, the main power supply circuit 341 starts, and after starting transmits and receives required data. According to this embodiment, the ON/OFF information on the main switch SW is received, the fuel valve 316 is closed at the time of OFF, and it releases it at the time of ON. Remaining fuel and cell temperature are transmitted outside, in the external vehicle controller 400, the fall of remaining fuel is got to know by communication, and the maximum output of the electrical motor 21 is extracted, or it is made to stop. In order for the time of low temperature to make degradation of the cell 302 prevent by getting to know cell temperature, the output of the electric motor 21 is extracted, and it is getting to know optimal temperature, and is made to correspond to full power.

[0055]accumulation consumption calculation of the efficiency map by the cell current value, the cell voltage value from the voltage detection sensor S13, and fuel consumption-production of electricity from the current detection sensor S12, etc. to fuel -- carrying out -- remaining fuel is calculated and it expresses as the lighting number of two or more LED which installed it in the remaining fuel indicator 350. In order to memorize the present remaining fuel at the time of the power supply OFF, it memorizes to the nonvolatile memory 342.

[0056]If the cell 302 begins power generation, in order for the rise of cell temperature to start and to maintain cell temperature at optimal temperature, the cell cooling fan 320 is driven and a temperature control is performed. The cell cooling fan 320 is stopped below with appropriate temperature for fuel consumption saving. In order to also use natural air cooling by a running wind effectively, it formed the cooling-wind-blows feed port 318 to the direction of movement, and has established the cooling-wind-blows exhaust port 319 back.

[0057]If it adjusts an air content, an air content is indirectly increased, in order that the air pump 321 may send in the air for a reaction and may adjust a production of electricity with the surveillance of cell voltage and cell current to the cell 302 and a production of electricity will increase and reduce, its production of electricity will decrease.

[0058]When the main switch SW is turned off, 0 (zero) is removed for remaining fuel and the fuel tank 301 is removed for cell temperature beyond as for an acceptable value, the fuel cell controller 303 of the fuel cell controller 303 is failure or a certain cause, When it stops functioning (if opening and closing of the fuel valve 316 are made into a magnetization type and it is made for the fuel valve 316 to close at the time of OFF) When the fuel cell controller 303 becomes out of control and magnetization is impossible, the fuel valve 316 is closed automatically. Sometimes, the fuel valve 316 is automatically closed at the time of detecting unexpected cell current/cell voltage etc.

[0059]Next, the control system of the hybrid type electric motor which makes the fuel cell 30 a driving source is explained based on drawing 4 and drawing 5. Drawing 4 is a block diagram of the control system of a hybrid type electric motor.

[0060]The electric power which the electric power extraction part 70 of the fuel cell 30 is electrically connected to the body side plug 63, and is taken out from the electric power extraction part 70 is sent to the motor drive circuit 404 via the power line 402,403 connected to the body side plug 63. The electric motor 21 is connected to this motor drive circuit 404 via the power line 405,406, and the motor drive circuit 404 drives the electric motor 21 to it based on the control signal from CPU407. CPU407 controls the motor drive circuit 404 based on the duty ratio of ON-OFF, and changes the output of the electric motor 21.

[0061]The current sensor S31 is formed in the power line 406, and this current sensor S31 detects electric motor current, and sends it to CPU407 via the interface (IF) 408. CPU407, the auxiliary power 409, and the power supply circuit 410 are connected to the power line 405,406 in parallel with the motor drive circuit 404. The auxiliary power 409 comprises a rechargeable battery, is a driving source of CPU407 and it gives auxiliary power to the motor drive circuit 404 via the power supply circuit 410.

[0062]The ON/OFF signal of the main switch SW is sent to CPU407 via the interface (IF) 411. The vehicle speed pulse from the speed sensor S51 is sent to CPU407 via the interface (IF) 412, and the input torque of the torque sensor S52 which detects the human power torque based on control force by foot is sent to CPU407 via the interface (IF) 413. CPU407 controls the motor drive circuit 404 so that it may change the output of the electric motor 21 so that it may become such big assistant ratio = motor output torque / input torque (0-1.0) that the vehicle speed is low so that the following may be carried out based on the vehicle speed by a vehicle speed pulse, and the treading strength by an input torque.

[0063]The remaining fuel information from CPU407 is sent to the display 71 via the interface (IF) 414.

[0064]The voltage detection sensor S13 which detects a cell voltage value is connected to the power line 330,331, fuel cell output voltage is detected, and it sends to CPU407 via the interface (IF) 415. The current detection sensor S12 which detects cell current is connected to the power line 330, fuel cell output current is detected, and it sends to CPU407 via the interface (IF) 415.

[0065]So that CPU407 may become an input torque and the assistant motor torque computed from the assistant ratio which becomes settled in the vehicle speed etc., So that the target motor required power computed from the vehicle speed and assistant motor torque may be supplied from the motor electric circuit 404, The supply output of electric motor 21 HE is computed from the motor current detection value of the current sensor S31, and the motor electric circuit 404 is controlled to bring the difference of a target motor required power value and the supply output value of electric motor 21 HE close to 0. CPU407 controls the fuel cell controller 303 so that the cell 302 outputs a target motor required power value. That is, a fuel cell control signal is sent to the external communication part 351 of the fuel cell controller 303

from the external communication part 401 so that a difference may bring the fuel cell output voltage which is a actual output from the cell 302, the fuel cell output value computed from fuel cell output current, and a target mho evening required power value close to 0.

[0066]The fuel cell controller 303 controls the fuel valve 316 via the air pump 321 and the actuator 317 based on a fuel cell control signal and fuel cell temperature, and controls the output power of the cell 302.

[0067]Drawing 5 is a control flow chart of the control system of a hybrid type electric motor.

[0068]In [if the main switch SW is turned on, flows of control will begin, and] Step a1, A main-switch SW state is judged with the vehicle controller 400, main-switch SW state information is sent to the fuel cell controller 303, and, in OFF, it shifts to Step a2, and remaining fuel data is memorized to the nonvolatile memory 342, and, in ON, it shifts to Step a3.

[0069]In Step a3, the seizing signal of the fuel cell 30 is sent to the fuel cell controller 303 from the vehicle controller 400, the air pump 321 and the fuel valve 316 are operated, and the cell 302 is started.

[0070]In Step a4, the vehicle speed is detected from the vehicle speed pulse from the speed sensor S51 with the vehicle controller 400.

[0071]In [in Step a5, read the A/D conversion value of electric motor current, treading-in torque, cell temperature, fuel cell output current, and fuel cell output voltage. and] Step a6, When it judges whether the fuel cell 30 is [*****] under starting in Step a7 when it judges whether there is any input torque of treading-in torque and there is an input torque, and the fuel cell 30 is starting, in Step a8, the vehicle speed judges that it is more than predetermined.

[0072]In Step a6, if prescribed period progress is judged and a prescribed period passes in Step a9 when there is no input torque, a fuel cell stop signal will be outputted in Step a10, and it will shift to Step a8. In Step a7, when the fuel cell 30 is not starting, in Step a11, a fuel cell seizing signal is outputted and it shifts to Step a8.

[0073]In Step a8, the vehicle speed judges that it is more than S2 predetermined, and when the vehicle speed is not more than [predetermined] S2, in Step a12, when it judges whether the fuel cell 30 is [******] under starting and the fuel cell 30 is starting, in Step a13, it is judged whether the remaining fuel reset switch S62 was pushed.

[0074]In Step a8, if prescribed period progress is judged and a prescribed period passes in Step a14 when the vehicle speed is more than [predetermined] S2, in Step a15, a fuel cell stop signal will be outputted and it will shift to Step a13. In Step a12, when the fuel cell 30 is not starting, in Step a16, a fuel cell seizing signal is outputted and it shifts to Step a13.

[0075]In Step a13, if the state of the remaining fuel reset switch S62 is judged and the remaining fuel reset switch S62 is pushed, in Step a17, fuel will be reset to 100% and fuel consumption will be computed in Step a18. In Step a13, if the remaining fuel reset switch S62 is not pushed, in Step a18, fuel consumption will be computed as it is.

[0076]accumulation consumption calculation of the efficiency map according [calculation of fuel consumption] to a cell current value, cell voltage value, and fuel consumption-production of electricity etc. to fuel -- carrying out -- remaining fuel is calculated and it expresses as the lighting number of two or more LED which installed it in the remaining fuel indicator 350 in Step a19.

[0077]In Step a20, judgment of being optimum reaction temperature and more than it is performed for cell temperature, and in Step a21, cell temperature sets an assistant ratio function as R1, and, in the case of beyond optimum reaction temperature and it, calculates the torque current of the electric motor 21 in Step a22.

[0078]In Step a20, when cell temperature is below optimum reaction temperature, in Step a23, it is set as the assistant ratio function according to cell temperature, and the torque current of the electric motor 21 is calculated in Step a22. The assistant ratio function according to cell temperature is set as R3, when temperature is low, R4 and temperature are high and R2 and temperature are middle.

[0079]It explains based on the figure showing the vehicle speed-assistant ratio of drawing 6 for calculation of this torque current, and the figures showing the treading strength torque target motor current of drawing 7.

[0080]In [the relation map of the vehicle speed-assistant ratio of drawing 6 is memorized by the memory in CPU407 of the vehicle controller 400, and take the vehicle speed along a horizontal axis, it takes an assistant ratio (tantheta) along a vertical axis, and] less than vehicle speed S2, Cell temperature is set as the assistant ratio according to optimum reaction temperature and the vehicle speed which is called for by the assistant ratio function R1 in the case of beyond it, and when cell temperature is below optimum reaction temperature, the assistant ratio function according to cell temperature is used. That is, when temperature is low, the assistant ratio function R4 and temperature are high and the assistant ratio function R2 and temperature are middle, the assistant ratio function R3 is used, and the assistant ratio according to the vehicle speed is computed and set up. According to each function, the vehicle speed approaches zero value, so that constant value and the vehicle speed increase by less than S1 and the vehicle speed increases between S1 and S2, and as for an assistant ratio, let the vehicle speed be zero value by more than S3.

[0081]It is assistant ratio =tantheta, and theta is a value of a function which becomes settled from the relation map of the vehicle speed-assistant ratio of drawing 6, and becomes settled by assistant ratio either the vehicle speed Sx or the functions which become settled in temperature conditions R1-R4.

[0082]Since the relation between assistant ratio = target motor torque / pedal torque becomes settled, target data current will multiply target motor torque by a constant and it will be asked for it if this theta value is calculated, By doubling the scale of a vertical axis (1/constant), the

figure showing the treading strength torque target motor current of drawing 7 is obtained, and a target data current value can be defined from the pedal torque value detected.

[0083]The relation map of the treading strength torque target motor current of drawing 7, Take the target motor current which drives pedal torque (treading strength torque) on a horizontal axis, and drives the electric motor 21 on a vertical axis, for example, cell temperature in drawing 6 by the case where the assistant ratio function R1 is set up in the case of beyond optimum reaction temperature and it. In the conditions of P1 at the time of vehicle speed Sx1, the line of an assistant ratio is called for in drawing 7 on the conditions of P2 at the time of vehicle speed Sx2 by the case where the line of the assistant ratio was called for in drawing 7, and the assistant ratio function R2 is set up by the case where cell temperature is below optimum reaction temperature, in drawing 6.

[0084]For example, target motor current value Iox1 for cell temperature to carry out the auxiliary drive of the wheel with the electric motor 21 in pedal torque (treading strength torque) value tx1 detected with the torque sensor S52 under run by the case beyond optimum reaction temperature and it vehicle speed Sx1 can be calculated.

[0085]Thus, in Step a24, a motor duty output is performed and the electric motor 21 is controlled to become the calculated target motor current value.

[0086]Hydrogen gas of specified pressure is added to the cell 302 of the fuel cell 30, and the fuel valve 316 comprises an opening and closing valve and pressure regulator valve.

[0087]hydrogen flow rate [of the fuel cell 30] = -- k-V-I/eta k:constant V:output voltage I:output current eta: -- it can ask at efficiency.

[0088]The fuel cell 30 drives the air pump 321 according to output current, and pneumatic pressure control is made.

[0089]The fuel cell 30 has the characteristic as shown in drawing 8. Drawing 8 is hydrogen pressure regularity, is relational data of the output current under a predetermined pneumatic pressure =f(i) function, and other outputs, voltage and efficiency, and is memorized in the memory of CPU407 as characteristic data of the fuel cell 30.

[0090]By the hydrogen flow rate type of the characteristic of the fuel cell 30 of drawing 8, and the fuel cell 30, the output current of the fuel cell 30 is supervised, and from current and voltage-characteristic-data efficiency data, fuel consumption can be computed and it can display on the remaining fuel indicator 350.

[0091]Thus, the control system of a hybrid type electric motor, The main drive system which drives the driving wheel which is the rear wheel 23 with main power, and the auxiliary power system which drives a driving wheel with the auxiliary power by the electric motor 21, The power supply which supplies electric power to the electric motor 21 and which contains the fuel cell 30 at least is carried, a power supply is started corresponding to change of the main drive by the main drive system, and the output of the electric motor 21 of an auxiliary power system

is controlled.

[0092]The temperature detecting means which comprises the cell temperature detection sensor S11 which detects the temperature of the fuel cell 30 in the control system of this hybrid type electric motor, It has a control means which comprises CPU407 which controls the required power of the electric motor 21 based on the temperature of a fuel cell. The temperature of the fuel cell 30 is detected and the required power of the electric motor 21 of an auxiliary power system is controlled based on the temperature of the fuel cell 30. That is, it is possible to combine electromotive force effectively corresponding to the operational status of a hybrid type electric motor, and to operate a fuel cell effectively by controlling to send the target data current corresponding to fuel cell temperature and the vehicle speed through the electric motor 21.

[0093]By a control means's controlling the required power of the electric motor 21 not to make the electric power more than permission output from the fuel cell 30, when the temperature of the fuel cell 30 is below prescribed temperature, and suppressing the output at the time of the low temperature of the fuel cell 30, Degradation of the fuel cell 30 can be prevented and fuel consumption efficiency can be raised.

[0094]The operational state detecting means which comprises the speed sensor S51 which detects the operational status of a hybrid type electric motor in the control system of a hybrid type electric motor, It has a control means which comprises CPU407 which controls the required power of the electric motor 21 based on operational status, Detect the operational status of a hybrid type electric motor, and the required power of the electric motor 21 of an auxiliary power system is controlled based on operational status, For example, unnecessary power consumption, such as stopping the fuel cell 30 for fuel economy for the reason for the legal restrictions which do not carry out electric assistance above the state which does not need electric assistance, such as waiting for a signal and a long downward slope, or regulation speed, can be prevented, and it becomes saving of the fuel of the fuel cell 30.

[0095]The output power detection means which comprises the voltage sensor S13 which detects the output power of the fuel cell 30, and the current sensor S12 in the control system of a hybrid type electric motor, The control means which comprises CPU407 which computes fuel consumption from the current, voltage characteristic data, and efficiency data which were beforehand memorized based on output power, It has a remaining fuel displaying means which comprises calculation of this fuel consumption with the remaining fuel indicator 350 and the display 71 which display remaining fuel, Detect the output power of the fuel cell 30 and fuel consumption is computed from the current, voltage characteristic data, and efficiency data which were beforehand memorized based on this output power, Remaining fuel is displayed from calculation of this fuel consumption, and an improvement of weight and cost can be aimed at by detecting remaining fuel by calculation without using the flow instrument for

detecting remaining fuel.

[0096]Although it has the auxiliary battery 340 which is a cell (capacity smallness) as the auxiliary power 409 and a power supply for fuel cell actuating which is a CPU power supply in this embodiment, When there is no cell for auxiliary power (capacity is large), the fuel cell 30 regulates the generating capacity of the fuel cell 30 corresponding to time short ** from the degree of low temperature, or an activation start, etc., and the rate (assistant ratio) of electromotive force over human power is lowered.

[0097]When it has the auxiliary battery 340 which is a cell as the auxiliary power 409 and a power supply for fuel cell actuating which is a CPU power supply, and a cell for ********* (capacity is large), The fuel cell 30 regulates the generating capacity of the fuel cell 30 corresponding to time short ** from the degree of low temperature, or an activation start, etc., however the rate of electromotive force over human power is not changed. However, an assistant ratio is lowered when the amount of residual battery capacities is small. Even when this amount of residual battery capacities is small, the fuel cell 30 makes an assistant ratio a steady-state value without regulating [in / from temperature or an activation start / time etc.] the generating capacity of 30 besides ****** enough.

[0098]Although it has the auxiliary battery 340 which is a cell (capacity smallness) as the auxiliary power 409 and a power supply for fuel cell actuating which is a CPU power supply, When there is no cell for auxiliary power (capacity is large), the fuel cell 30 controls the generating capacity of the fuel cell 30 enough enough corresponding to [cases, such as time,] the human power of the main drive system from temperature or an activation start. Since change is large, human power controls the generating capacity of the fuel cell 30 corresponding to the average treading strength for the number stroke of steps (human power torque), The amount of treading strength (human power torque) change can arrange the cell or capacitor of small capacity, it can be operated as a buffer of charge and discharge, and can maintain an assistant ratio to a predetermined value as a result. However, the speed sensor S51 is formed, according to the vehicle speed, vehicle speed Hirotoki lowers the predetermined value of an assistant ratio, when the vehicle speed is slow, the predetermined value of an assistant ratio is raised, and the fuel cell 30 is controlled so that the generating capacity which multiplied human power by this predetermined value is acquired.

[0099]The generating capacity of the fuel cell 30, The amount of output current or output cell from an output controlling circuit arranged in the middle of. [the output circuit of the air pump 321 which are the amount-of-supply control actuator 317 of fuel (hydrogen gas or methanol (liquid or gas)), and an amount-of-supply control actuator of oxygen, or the fuel cell 30] It carries out by controlling the variable circuit characteristic element of an output controlling circuit so that it may be made to agree with a desired value

[0100]Although the remaining fuel indicator 350 provided in the cartridge 300 which is the

display 71 and container which were formed in the bicycle side (center section of the right-and-left handle) about remaining fuel is arranged, a display may be arranged to the tank side. The power generation information of the fuel cell 30 and assistant ratio information are also displayed on the bicycle side (a lamp, a buzzer, LED, or liquid crystal display).

[0101]In the embodiment of the above-mentioned hybrid type electric motor, the assistant ratio calculated from the vehicle speed of the assistant functions R1-R4 chosen by the cell temperature of the fuel cell 30 is set to 1.0 at the maximum. That is, although the hybrid type electric motor which carries the fuel cell 30 as a power supply was the bicycle 1 with electric assistance which makes auxiliary power the motor output which makes the input used as the 1st power main power, and turns into the 2nd power, it is good also not only considering this embodiment but an assistant ratio as 0-3.0. Human power which becomes 1.0 or more, i.e., the 1st power, about an assistant ratio in every vehicle speed is made into auxiliary power, it is considered as the battery-assisted bicycle which makes the motor output used as the 2nd power the main auxiliary power, and the maximum assistant ratio is also good also as 10-20 depending on the case. In this case, the pedal 14 serves as an accelerator device for the output adjustments of the electric motor 21 which is main power rather than calling it an auxiliary power grant means.

[0102]One-way rotation KURATTE which permits only the transmitting power of the direction of the crankshaft 12 for the transmitting power course from the pedal 14 to the crankshaft 12 may be arranged. Even if it does not row the pedal 14, unless an unillustrated brake is made to act, it can be made to run with constant speed or a regularity electric output before stopping the pedal 14 with the output of the electric motor 21. While applying mechanical braking power to the front wheel 8 or the rear wheel 23 at the time of a brake action, the electric power supply to the electric motor 21 is stopped.

[0103]In the battery-assisted bicycle which makes human power main power or auxiliary power, it is still better also as a run only by human power being possible to arrange a clutch for the transmitting power course from the electric motor 21 to the crankshaft 12, or arrange electric motor 21 safety switch. In this case, loads, such as frictional force of the electric motor 21, can reduce the part which becomes small or the part whose generating load by the electric motor 21 generating electromotive force is lost, and treading strength.

[0104]Further, simultaneous or individually, in the hybrid type battery-assisted bicycle which can act on a driving wheel, although he is trying to transmit the output of the electric motor 21 to the rear wheel 23 via the chain which is a power transmission device of human power, the human power and electromotive force of each of said embodiment, It may be made to drive the direct front wheel 8 or the rear wheel 23 via a chain. Also in this case, a clutch may be arranged for the transmitting power course from the electric mho evening 21 to front ** 8 or the rear wheel 23

current, voltage characteristic data, and efficiency data which were beforehand memorized based on output power, It has a remaining fuel displaying means which displays remaining fuel from calculation of this fuel consumption. Detect the output power of a fuel cell and fuel consumption is computed from the current, voltage characteristic data, and efficiency data which were beforehand memorized based on this output power. Remaining fuel is displayed from calculation of this fuel consumption, and an improvement of weight and cost can be aimed at by detecting remaining fuel by calculation without the flow instrument for detecting remaining fuel using it.

[Translation done.]

[0105]As a hybrid type battery-assisted bicycle, four wheel vehicles not only like the above-mentioned two-wheeled vehicle but an electric wheelchair may be used. addition of a direct entry being enabled in an electric wheelchair at the rear wheel of a major diameter, and connecting with a rear wheel -- ** -- even if small, a hybrid run with the electromotive force of an electric motor and human power which are made into one fuel cell of a power supply is enabled.

[0106]

[Effect of the Invention]By the above explanation so that clearly in the invention according to claim 1. By having a temperature detecting means which detects the temperature of a fuel cell, and a control means which controls the required power of an electric motor based on the temperature of a fuel cell, detecting the temperature of a fuel cell, and controlling the required power of an electric motor based on the temperature of a fuel cell. It is possible to combine electromotive force effectively corresponding to the operational status of a hybrid type electric motor, and to operate a fuel cell effectively.

[0107]The temperature detecting means which detects the temperature of a fuel cell in the invention according to claim 2, By having a control means which controls the required power of an electric motor based on the temperature of a fuel cell, detecting the temperature of a fuel cell, and controlling the required power of the electric motor of the 2nd power system based on the temperature of a fuel cell. It is possible to combine electromotive force effectively corresponding to the operational status of a hybrid type electric motor, and to operate a fuel cell effectively.

[0108]In the invention according to claim 3, when the temperature of a fuel cell is below prescribed temperature, by controlling the required power of an electric motor not to make the electric power more than permission output from a fuel cell, and suppressing the output at the time of the low temperature of a fuel cell, degradation of a fuel cell can be prevented and fuel consumption efficiency can be raised.

[0109]The operational state detecting means which detects the operational status of a hybrid type electric motor in the invention according to claim 4, It has a control means which controls the required power of an electric motor based on operational status, Detect the operational status of a hybrid type electric motor, and the required power of the electric motor of the 2nd power system is controlled based on operational status, For example, unnecessary power consumption, such as stopping a fuel cell for fuel economy for the reason for the legal restrictions which do not carry out an electric output above the state which does not need electric outputs, such as waiting for a signal and a long downward slope, or regulation speed, can be prevented, and it becomes saving of the fuel of a fuel cell.

[0110]An output power detection means to detect the output power of a fuel cell in the invention according to claim 5, The control means which computes fuel consumption from the

TECHNICAL FIELD

[Field of the Invention]This invention relates to the control system of the hybrid type electric motor which carries a fuel cell at least and was made to **** the output of said electric motor which drives said driving wheel and which supplies electric power to an electric motor and this electric motor at least while driving a driving wheel based on two or more sources of power.

[Translation done.]

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PRIOR ART

[Description of the Prior Art]For example, although there is a battery-assisted bicycle which makes human power the 1st power as one of the hybrid type electric motors, generally, the source of power is a rechargeable battery, and if a rechargeable battery is charged via a battery charger from a home power supply before a run and the capacity of a rechargeable battery is lost, it will use it, charging again.
[0003]In such a battery-assisted bicycle, since charge takes several hours and a run becomes impossible in the meantime, hydrogen Bon ** or a reformer, and a fuel cell are carried in JP,8-119180,A, and there are some which drive an electric motor in it, for example.
[0004]A hybrid type electric motor has the indication of what has rechargeable batteries, such as a fuel cell and a battery, as the source of power, and the thing which carries a reformer as a hydrogen supply system to a fuel cell further. In what carries a reformer, the temperature of a reforming catalyst part is detected and there is an indication of what carries out reforming catalyst part heating according to temperature.

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EFFECT OF THE INVENTION

[Effect of the Invention]By the above explanation so that clearly in the invention according to claim 1. By having a temperature detecting means which detects the temperature of a fuel cell, and a control means which controls the required power of an electric motor based on the temperature of a fuel cell, detecting the temperature of a fuel cell, and controlling the required power of an electric motor based on the temperature of a fuel cell. It is possible to combine electromotive force effectively corresponding to the operational status of a hybrid type electric motor, and to operate a fuel cell effectively.

[0107]The temperature detecting means which detects the temperature of a fuel cell in the invention according to claim 2, By having a control means which controls the required power of an electric motor based on the temperature of a fuel cell, detecting the temperature of a fuel cell, and controlling the required power of the electric motor of the 2nd power system based on the temperature of a fuel cell. It is possible to combine electromotive force effectively corresponding to the operational status of a hybrid type electric motor, and to operate a fuel cell effectively.

[0108]In the invention according to claim 3, when the temperature of a fuel cell is below prescribed temperature, by controlling the required power of an electric motor not to make the electric power more than permission output from a fuel cell, and suppressing the output at the time of the low temperature of a fuel cell, degradation of a fuel cell can be prevented and fuel consumption efficiency can be raised.

[0109]The operational state detecting means which detects the operational status of a hybrid type electric motor in the invention according to claim 4, It has a control means which controls the required power of an electric motor based on operational status, Detect the operational status of a hybrid type electric motor, and the required power of the electric motor of the 2nd power system is controlled based on operational status, For example, unnecessary power consumption, such as stopping a fuel cell for fuel economy for the reason for the legal

restrictions which do not carry out an electric output above the state which does not need electric outputs, such as waiting for a signal and a long downward slope, or regulation speed, can be prevented, and it becomes saving of the fuel of a fuel cell.

[0110]An output power detection means to detect the output power of a fuel cell in the invention according to claim 5, The control means which computes fuel consumption from the current, voltage characteristic data, and efficiency data which were beforehand memorized based on output power, It has a remaining fuel displaying means which displays remaining fuel from calculation of this fuel consumption, Detect the output power of a fuel cell and fuel consumption is computed from the current, voltage characteristic data, and efficiency data which were beforehand memorized based on this output power, Remaining fuel is displayed from calculation of this fuel consumption, and an improvement of weight and cost can be aimed at by detecting remaining fuel by calculation without the flow instrument for detecting remaining fuel using it

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]By the way, to the conventional thing, the indication of how to control power generation of a fuel cell corresponding to a run of a hybrid type electric motor is absolutely none, and. There is no indication of combining the 2nd power effectively to the 1st power corresponding to the traveling condition of a hybrid type electric motor, and making it operate a fuel cell effectively etc.
[0006]The reactivity of hydrogen and oxygen is blunt, and in using a fuel cell especially, if the electric power more than predetermined is taken out, it will do damage not only to fuel efficiency but to the fuel cell itself, until a fuel cell goes up to optimal temperature as the characteristic of a fuel cell. Even when an electric output has not been carried out, in order to maintain the power generation operation of a fuel cell body, there is a problem of fuel being consumed continuously.
[0007]An object of this invention is to provide the control system of the hybrid type electric motor which it was made in view of this point, and electromotive force is effectively combined corresponding to the operational status of a hybrid type electric motor, and can operate a fuel cell effectively.

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MEANS

[Means for Solving the Problem]In order to solve said technical problem and to attain the purpose, this invention was constituted as follows.
[0009]While the invention according to claim 1 drives "driving wheel based on two or more sources of power, In a hybrid type electric motor which carries a power supply which drives said driving wheel, which supplies electric power to an electric motor and this electric motor at least, and which contains a fuel cell at least, and controlled an output of said electric motor, Control system of a hybrid type electric motor provided with a temperature detecting means which detects temperature of said fuel cell, and a control means which controls required power of said electric motor based on temperature of said fuel cell. It is ".
[0010]According to this invention according to claim 1, it is possible to detect temperature of a fuel cell, and to combine electromotive force effectively corresponding to operational status of a hybrid type electric motor by controlling required power of an electric motor based on temperature of a fuel cell, and to operate a fuel cell effectively.
[0011]The 1st drive system in which the invention according to claim 2 drives "driving wheel with the 1st power, The 2nd power system that drives said driving wheel with the 2nd power by an electric motor, A power supply which supplies electric power to said electric motor and which contains a fuel cell at least is carried, In a control system of a hybrid type electric motor which starts said power supply corresponding to change of the 1st drive by said 1st drive system, and controls an output of an electric motor of said 2nd power system, Control system of a hybrid type electric motor provided with a temperature detecting means which detects temperature of said fuel cell, and a control means which controls required power of said electric motor based on temperature of said fuel cell. It is ".
[0012]According to this invention according to claim 2, it is possible to detect temperature of a fuel cell, and to combine electromotive force effectively corresponding to operational status of a hybrid type electric motor by controlling required power of an electric motor of the 2nd power

system based on temperature of a fuel cell, and to operate a fuel cell effectively.

[0013]The invention according to claim 3 the "aforementioned control means, Control system of the hybrid type electric motor according to claim 1 or 2 controlling required power of said electric motor not to make electric power more than permission output from said fuel cell when temperature of said fuel cell is below prescribed temperature. It is ".

[0014]By controlling required power of an electric motor not to make electric power more than permission output from a fuel cell, and suppressing an output at the time of low temperature of a fuel cell, when temperature of a fuel cell is below prescribed temperature according to this invention according to claim 3, Degradation of a fuel cell can be prevented and fuel consumption efficiency can be raised.

[0015]The 1st drive system in which the invention according to claim 4 drives "driving wheel with the 1st power, The 2nd power system that drives said driving wheel with the 2nd power by an electric motor, A power supply which supplies electric power to said electric motor and which contains a fuel cell at least is carried, In a control system of a hybrid type electric motor which starts said power supply corresponding to change of the 1st drive by said 1st drive system, and controls an output of an electric motor of said 2nd power system, Control system of a hybrid type electric motor provided with an operational state detecting means which detects operational status of said hybrid type electric motor, and a control means which controls required power of said electric motor based on operational status, It is ".

[0016]According to this invention according to claim 4, operational status of a hybrid type electric motor is detected, Based on operational status, control required power of an electric motor of the 2nd power system, and For example, a state which does not need electric outputs, such as waiting for a signal, and a long downward slope, Or unnecessary power consumption, such as stopping a fuel cell for fuel economy for a reason for legal restrictions which do not carry out an electric output above regulation speed, can be prevented, and it becomes saving of fuel of a fuel cell.

[0017]The 1st drive system in which the invention according to claim 5 drives "driving wheel with the 1st power, The 2nd power system that drives said driving wheel with the 2nd power by an electric motor, A power supply which supplies electric power to said electric motor and which contains a fuel cell at least is carried, In a control system of a hybrid type electric motor which starts said power supply corresponding to change of the 1st drive by said 1st drive system, and controls an output of an electric motor of said 2nd power system, An output power detection means to detect output power of said fuel cell, and a control means which computes fuel consumption from current, voltage characteristic data, and efficiency data which were beforehand memorized based on said output power, Control system of a hybrid type electric motor provided with a remaining fuel displaying means which displays remaining fuel from calculation of this fuel consumption. It is ".

[0018]According to this invention according to claim 5, output power of a fuel cell is detected, Without using a flow instrument for computing fuel consumption, displaying remaining fuel from calculation of this fuel consumption, and detecting remaining fuel from current, voltage characteristic data, and efficiency data which were beforehand memorized based on this output power, An improvement of weight and cost can be aimed at by detecting remaining fuel by calculation.

[0019]

[Embodiment of the Invention]Below, the embodiment of the control system of the hybrid type electric motor of this invention is described based on an accompanying drawing. It is a figure showing the state where drawing 1 removed the side view of the hybrid type electric motor, and drawing 2 removed the power supply of the hybrid type electric motor.

[0020]By this embodiment, human power used as the 1st power is made into main power as a hybrid type electric motor, and the bicycle 1 with electric assistance which makes auxiliary power the motor output used as the 2nd power is shown. This bicycle 1 with electric assistance has the car body frame 2, and is inserted in in the head tube 4 located ahead [of the main pipe 3 which constitutes this car body frame 2 / body], enabling free rotation of the handle stem 5. The handle 6 is formed in the upper bed part of the handle stem 5, and the front fork 7 is formed in the lower end part of the handle stem 5. The main switch SW is formed in the handle 6, and the control system of a hybrid type electric motor operates with this main switch SW for it.

[0021]The front wheel 8 is supported pivotally by the lower end of the front fork 7, enabling free rotation. The speed sensor S51 is formed in the shank of the front wheel 8 of the front fork 7. From the head tube 4, the main pipe 3 had extended in the slanting lower part toward body back, was further crooked in the lower part, and is prolonged back. From the back end of this main pipe 3, the seat tube 9 is set up by the slanting upper part toward body back. The saddle 11 is supported by the upper bed part of the seat tube 9 via the seat pillar 10, and height adjustment is possible at operation of the height adjustment handle 60.

[0022]It is the abbreviated central lower part of the body, and the power unit 20 is hung by the joining segment of the main pipe 3 and the seat tube 9 via the bracket 19. The power unit 20 puts side by side the main drive system by a crew member's treading strength, and the auxiliary power system by the electric motor 21, and is constituted, The crankshaft 12 is supported movably by this, enabling free rotation, the crank 13 is attached to the both the right and left ends of the crankshaft 12, and the pedal 14 is supported pivotally by the end of each crank 13.

[0023]It is a time of the main switch SW being an ON state, and only when a crew member's treading strength is applied to the crankshaft 12 from the pedal 14, the electric motor 21 is rotated and the power from the electric motor 21 is told to the crankshaft 12. That is, when the

pedal 14 is stepped on, in addition to the treading strength, the running torque from the electric motor 21 will be given to the crankshaft 12. The output of this electric motor 21 is controlled to abbreviated-be proportional to the treading strength applied to the pedal 14, and this treading strength is detected by the torque sensor S52 in the power unit 20.

[0024]From the bracket 19, the chain stay 25 of the right-and-left couple is installed toward body back, and the rear end part of the chain stay 25 is connected with the lower end of the seat stay 22 of the right-and-left couple which extends in a slanting lower part toward the upper bed empty vehicle object back of the seat tube 9. The rear wheel 23 is supported pivotally by the connecting part of the chain stay 25 and the seat stay 22, enabling free rotation. In the seat stay 22, the rear wheel locking device 24 for theft prevention is formed, and rotation of the rear wheel 23 is locked with the rear wheel locking device 24.

[0025]It has the fuel cell 30 which is a power supply which supplies electric power between the seat tube 9 and the rear wheel 23 at the electric motor 21 above the power unit 20 removable. The fuel cell receptacle 34 is formed in the bracket 19, and the fuel cell locking device 35 is formed in this fuel cell receptacle 34. Where the fuel cell receptacle 34 is equipped with the fuel cell 30, the lock pin 51 engages with the engaging recess 32d of the fuel cell 30, and is locked.

[0026]The body side plug 63 is being fixed to the pars basilaris ossis occipitalis of the fuel cell receptacle 34. The fuel cell 30 has the connectable electric power extraction part 70 electrically to the body side plug 63, where the body is equipped. The fuel cell 30 is it being removable, and this electric power extraction part's 70 being formed in the lower part of the fuel cell 30 along with the upper guide 42 and the lower guide 37, and equipping with the fuel cell 30 along with the upper guide 42 and the lower guide 37, and the body side plug 63 is electrically connected with the electric power extraction part 70.

[0027]The upper guide 42 is being fixed to the seat tube 9. As for the lower guide 37, the lower part 37a is fixed to the fuel cell receptacle 34, and the upper part 37b is being fixed to the rear fender 28 via the locking tool 40.

[0028]The bracket 53 of the saddle 11 is rotatable about the holding pin 54 to the bracket 52 fixed to the upper part of the seat pillar 10 at the fulcrum. The lock pin 55 is being fixed to the bracket 52 of the seat pillar 10. The holding pin 57 is formed in the locking lever 56 by the bracket 53 of the saddle 11 rotatable at a fulcrum. This locking lever 56 is energized by the spring 58 so that the claw part 56a may engage with the lock pin 55. The saddle 11 can be moved to a front position by rotating the locking lever 56 by hand and removing the claw part 56a from the lock pin 55, and the fuel cell 30 can be detached and attached into the body in this state

[0029]The handle 6 is equipped with the display 71, the remaining fuel of the fuel cell 30, etc. are displayed on it with this display 71, and it enables it to tell a driver about the state of the

fuel cell 30.

[0030]Next, the composition of the fuel cell 30 is explained based on drawing 3. Drawing 3 is a block diagram showing the composition of a fuel cell.

[0031]The fuel cell 30 of this embodiment is a cartridge-type, is stored by the cartridge 300 and constitutes the fuel cell unit. In the cartridge 300 of a fuel cell unit, the fuel tank 301 is arranged at the lower part, the fuel cell body 302, i.e., a cell, is arranged in the center section, and the fuel cell controller 303 is arranged in the upper part. It is a fuel cell unit's being a gestalt which stores the cell 302 as basic constitution of the fuel cell 30, the fuel cell controller 303, and the fuel tank 301 to the cartridge 300 of one box, arranging a component in a column, and considering it as long and slender shape, It can be made the shape which is easy to include also in narrow vehicles.

[0032]Since the fuel cell 30 of a cartridge-type becomes the weight of several kilograms on the whole, it tends to treat the way which is stood downward and with which load is equipped, and, in a direction narrow in unit shape, the flexibility in a mounting surface goes up it. Therefore, when fuel is hydrogen, as a layout at this time, from the bottom, it is considered as the order of the fuel tank 301, the cell 302, and the fuel cell controller 303, and a component unit is arranged in a column. Since heat occurs and the upper part gets warm easily by an air convection with power generation from the cell 302, in order to avoid heating of the fuel tank 301, the fuel tank 301 is arranged in the lower part of the cell 302.

[0033]Thus, since those upper parts will also be heated by an air convection if the cell 302 and fuel cell controller 303 grade may be heated by the contingency, When fuel is a fluid, the fuel tank 301 is arranged to the cell 302 up side, and it may be made arrange the fuel tank 301 to the cell 302 and fuel cell controller 303 down side so that the fuel tank 301 may not be heated superfluously, but to supply fuel by a natural fall.

[0034]That is, since fuel will carry out a natural fall to the cell 302 with gravity if fuel arranges the fuel tank 301 in the upper part of the cell 302 in the case of a fluid etc., a component like a pumping pump becomes unnecessary and it becomes advantageous in respect of cost, a payload, etc. In this case, in order to prevent the fuel tank 301 from being heated by the air convection by cell waste heat, cell storage space provides the fuel tank storage space of the isolated another room, and attaches thermal insulation to a septum. In order to prevent thermal insulation from igniting with hotter waste heat etc., fuel tank storage space is further covered with an incombustible material.

[0035]The fuel cell 30 is equipped with the auxiliary battery 340. For cell starting, the auxiliary battery 340 starts the fuel cell controller 303 by the main power supply circuit 341, and it makes the air pump 321 drive, or the fuel valve 316 is opened and closed via the actuator 317, or it serves as a power supply to the fuel cell controller 303. This auxiliary battery 340 charges a part for the consumed electric power in response to supply after starting of the cell 302 from

the cell 302.

[0036]The fuel cell controller 303 is equipped with the nonvolatile memory 342, and remaining fuel data etc. are memorized by the nonvolatile memory 342. The remaining fuel indicator 350 is formed in the upper part of the fuel cell 30, and the fuel of the fuel tank 301 is displayed on it by LED. Thus, the fuel cell controller 303 makes a remaining fuel display make it serve a double purpose, and it arranges the remaining fuel indicator 350 at the topmost part so that it may be easy to recognize visually from the upper part.

[0037]The fuel tank 301 is arranged in the fuel tank storing chamber 304a formed with the fuel tank containing case 304, This fuel tank storing chamber 304a is open for free passage with the wind hole 306 formed in the cartridge 300 via the introduction duct 305, and is open for free passage with the exhaust port 308 formed in the cartridge 300 via the exhaust duct 307.

[0038]The running wind which it was located in the before [a vehicle traveling direction] side, and the exhaust port 308 was located in the before [a vehicle traveling direction] side, and was taken in from the wind hole 306 the wind hole 306, He flows through the fuel tank storing chamber 304a via the introduction duct 305, and is trying for the fuel temperature of the fuel tank 301 to turn into outdoor air temperature by being exhausted from the exhaust port 308 via the exhaust duct 307. In order to bring forward the gas diffusion to the inside of the atmosphere at the time of fuel gas leakage, the fuel tank containing case 304 was made into the another room structure intercepted by the septum, and the wind hole 306 and the exhaust port 308 which are fresh air inlets with the open air are established. Thus, if fuel tank storage space and cell storage space are isolated by the septum 311 and a wind hole is provided in the upper part of the septum 311 in a direction of movement and its tail end, respectively, hydrogen will be back spread in the atmosphere smoothly by the characteristic lighter than air and the flow of a running wind.

[0039]At the time of leakage, since it is generally lighter than air, fuel gas is making the wall of the fuel tank storing chamber 304a incline toward back, uniting, and arranging the exhaust port 308 in a position higher than the wind hole 306, and is carried out that it is easy to diffuse gas back so that it may be spread promptly back.

[0040]Thus, in the case of gases, such as hydrogen gas, supposing the gas leakage from the fuel tank 301, a fuel tank storage ventilates well and the fuel of the fuel tank 301 leads to the open air. If the wall of the septum 311 is made to incline toward back and it provides in it with the back exhaust port 308 at a high position, the gas which leaked will become also in the state of a vehicle interdiction that it is easy to be spread back.

[0041]The thermal insulation 309a and the incombustible material 309b are formed in the fuel tank containing case 304. By covering the fuel tank storing chamber 304a with the thermal insulation 309a, it can carry out as [heat / the fuel tank 301 / carelessly] with the waste heat of the cell 302, etc. By covering the fuel tank storing chamber 304a with the incombustible

material 309b, by the cell 302, the short circuit of the fuel cell controller 303, etc., even if the circumference heats, it is carrying out as [be / it / less than the fuel tank 301]. It dissociated by the septum 311 and the fuel tank storing chamber 304a and the cell storing chamber 310 have reduced the thermal effect to the fuel tank 301.

[0042]The fuel tank mounting detecting switch S61, the remaining fuel reset switch S62, and the fuel leakage detector 312 are arranged at the fuel tank containing case 304. The fuel tank mounting detecting switch S61 detects attachment/removal of the fuel tank 301, and sends this information to the fuel cell controller 303. In the fuel cell controller 303, supply of fuel is enabled from the fuel tank 301 by attachment detection at the cell 302, by removal detection, the actuator 317 of the fuel valve 316 is operated and the fuel valve 316 closes.

[0043]The remaining fuel reset switch S62 operates at the time of exchange of the fuel tank 301, sends remaining fuel reset information to the fuel cell controller 303, and resets the remaining fuel of nonvolatile MOMERI 342 of the fuel cell controller 303.

[0044]From the fuel tank 301, the fuel leakage detector 312 (if it is hydrogen gas hydrogen gas sensor) is located in the downstream, detects fuel leakage, sends fuel leakage information to the fuel cell controller 303, and the fuel cell controller 303 closes the fuel valve 316, and it suspends power generation.

[0045]The fuel tank mounting-and-fixing part 313 is formed in the fuel tank storing chamber 304, and the exchangeable fuel tank 301 is fixed to it. The fuel output port 314 is established in this fuel tank mounting-and-fixing part 313, and the fuel taken out from this fuel output port 314 is supplied to the cell 302 via the fuel supply piping 315.

[0046]The fuel valve 316 is formed in the fuel supply piping 315, and this fuel valve 316 is opened and closed with the actuator 317 to it. The actuator 317 opens and closes the fuel valve 316 based on the instructions from the fuel cell controller 303, and controls the fuel supplied to the cell 302. If opening and closing of the fuel valve 316 are automated by the fuel cell controller 303 and the actuator 317, the fuel valve 316 is opened in operation in the normal state and fuel is exhausted, the fuel tank 301 will be removed or a certain failure will close the fuel valve 316 in a use unexpected situation.

[0047]The cooling-wind-blows feed port 318 is opened for free passage and established in the before [a vehicle traveling direction] side at the cell storing chamber 310, and the cooling-wind-blows exhaust port 319 is opened for free passage and established in the cartridge 300 at the cell storing chamber 310 at the backside [the vehicle traveling direction]. In the cell storing chamber 310, the cell cooling fan 320 is arranged and this cell cooling fan 320 is driven by the fuel cell controller 303. Cooling wind blows are compulsorily taken in by the drive of this cell cooling fan 320 from the cooling-wind-blows feed port 318 to the cell storing chamber 310, the cell 302 is cooled, it is exhausted from the cooling-wind-blows exhaust port 319, and the running wind of vehicles is used for cell cooling.

[0048]In the cell storing chamber 310, the air pump 321 is arranged and this air pump 321 is driven by the fuel cell controller 303. Air is supplied to the cell 302 by the drive of this air pump 321 via the air supply piping 322.

[0049]If the composition of the cell 302 of the fuel cell 30 is explained briefly, hydrogen used as fuel is supplied to a cathode pole (negative pole) from the fuel tank 301, and from the air pump 321, air will be ****(ed) as an oxidizer to the anode pole (anode), and it will generate electricity by performing electrochemical reaction by a catalyst. A polymers ion-exchange membrane is infixed between two electrodes. Water is supplied in order to get wet in order to secure the permeability of a hydrogen ion to this ion-exchange membrane and to make it move to it smoothly, and to change into a state. The cell 302 is constituted by making such an electrode pair into a unit, and the fuel cell of the prescribed output which totaled the electromotive force of each cell 302 combining the cell 302 of two or more sheets is formed. Generation of heat accompanying the electromotive force reaction of the cell 302 passes air on the periphery of the cell 302, and cools on it.

[0050]For example by using methanol as primary fuel, hydrogen used as fuel mixes this with water, and heating evaporation is carried out, The catalytic reaction of a reformer decomposes into hydrogen and carbon dioxide, and after reducing the concentration of the carbon monoxide by which it was generated in the minute amount with the reformer via a shift converter, a selective oxidation reactor, etc., this hydrogen gas is supplied to the anode electrode of the cell 302 of a fuel cell. Or direct supply of the hydrogen gas may be carried out from a cylinder.

[0051]The electric power of the cell 302 is taken out with the power line 330,331 to the electric power extraction part 70, and the diode D1 of prevention of backflow is connected to the power line 330. In the cell 302, the cell temperature detection sensor S11 is formed, this cell temperature detection sensor S11 detects cell temperature in it, and it sends to the fuel cell controller 303.

[0052]The external communication part 351 is formed in the fuel cell controller 303. In this external communication part 351, the ON/OFF information on the main switch SW, external abnormality information, and a fuel cell controller seizing signal, A fuel cell control signal etc. are received from the external communication part 401 of the vehicle controller 400, and, on the other hand, remaining fuel information, remaining fuel reset switch information, fuel-cell-temperature information, and the abnormality information of the fuel cell 30 are transmitted to the external communication part 401 of the vehicle controller 400 by the external communication part 351.

[0053]Thus, the fuel cell controller 303 has a function which communicates with the exterior, and serves as starting of the fuel cell controller 303 and the switch of OFF. A power supply is turned OFF after closing the fuel valve 316 to the main power supply circuit 341, when there is

no communication from the outside.

[0054]By arrival of a data signal, the main power supply circuit 341 starts, and after starting transmits and receives required data. According to this embodiment, the ON/OFF information on the main switch SW is received, the fuel valve 316 is closed at the time of OFF, and it releases it at the time of ON. Remaining fuel and cell temperature are transmitted outside, in the external vehicle controller 400, the fall of remaining fuel is got to know by communication, and the maximum output of the electrical motor 21 is extracted, or it is made to stop. In order for the time of low temperature to make degradation of the cell 302 prevent by getting to know cell temperature, the output of the electric motor 21 is extracted, and it is getting to know optimal temperature, and is made to correspond to full power.

[0055]accumulation consumption calculation of the efficiency map by the cell current value, the cell voltage value from the voltage detection sensor S13, and fuel consumption-production of electricity from the current detection sensor S12, etc. to fuel -- carrying out -- remaining fuel is calculated and it expresses as the lighting number of two or more LED which installed it in the remaining fuel indicator 350. In order to memorize the present remaining fuel at the time of the power supply OFF, it memorizes to the nonvolatile memory 342.

[0056]If the cell 302 begins power generation, in order for the rise of cell temperature to start and to maintain cell temperature at optimal temperature, the cell cooling fan 320 is driven and a temperature control is performed. The cell cooling fan 320 is stopped below with appropriate temperature for fuel consumption saving. In order to also use natural air cooling by a running wind effectively, it formed the cooling-wind-blows feed port 318 to the direction of movement, and has established the cooling-wind-blows exhaust port 319 back.

[0057]If it adjusts an air content, an air content is indirectly increased, in order that the air pump 321 may send in the air for a reaction and may adjust a production of electricity with the surveillance of cell voltage and cell current to the cell 302 and a production of electricity will increase and reduce, its production of electricity will decrease.

[0058]When the main switch SW is turned off, 0 (zero) is removed for remaining fuel and the fuel tank 301 is removed for cell temperature beyond as for an acceptable value, the fuel cell controller 303 of the fuel cell controller 303 is failure or a certain cause, When it stops functioning (if opening and closing of the fuel valve 316 are made into a magnetization type and it is made for the fuel valve 316 to close at the time of OFF) When the fuel cell controller 303 becomes out of control and magnetization is impossible, the fuel valve 316 is closed automatically. Sometimes, the fuel valve 316 is automatically closed at the time of detecting unexpected cell current/cell voltage etc.

[0059]Next, the control system of the hybrid type electric motor which makes the fuel cell 30 a driving source is explained based on drawing 4 and drawing 5. Drawing 4 is a block diagram of the control system of a hybrid type electric motor.

[0060]The electric power which the electric power extraction part 70 of the fuel cell 30 is electrically connected to the body side plug 63, and is taken out from the electric power extraction part 70 is sent to the motor drive circuit 404 via the power line 402,403 connected to the body side plug 63. The electric motor 21 is connected to this motor drive circuit 404 via the power line 405,406, and the motor drive circuit 404 drives the electric motor 21 to it based on the control signal from CPU407. CPU407 controls the motor drive circuit 404 based on the duty ratio of ON-OFF, and changes the output of the electric motor 21.

[0061]The current sensor S31 is formed in the power line 406, and this current sensor S31 detects electric motor current, and sends it to CPU407 via the interface (IF) 408. CPU407, the auxiliary power 409, and the power supply circuit 410 are connected to the power line 405,406 in parallel with the motor drive circuit 404. The auxiliary power 409 comprises a rechargeable battery, is a driving source of CPU407 and it gives auxiliary power to the motor drive circuit 404 via the power supply circuit 410.

[0062]The ON/OFF signal of the main switch SW is sent to CPU407 via the interface (IF) 411. The vehicle speed pulse from the speed sensor S51 is sent to CPU407 via the interface (IF) 412, and the input torque of the torque sensor S52 which detects the human power torque based on control force by foot is sent to CPU407 via the interface (IF) 413. CPU407 controls the motor drive circuit 404 so that it may change the output of the electric motor 21 so that it may become such big assistant ratio = motor output torque / input torque (0-1.0) that the vehicle speed is low so that the following may be carried out based on the vehicle speed by a vehicle speed pulse, and the treading strength by an input torque.

[0063]The remaining fuel information from CPU407 is sent to the display 71 via the interface (IF) 414.

[0064]The voltage detection sensor S13 which detects a cell voltage value is connected to the power line 330,331, fuel cell output voltage is detected, and it sends to CPU407 via the interface (IF) 415. The current detection sensor S12 which detects cell current is connected to the power line 330, fuel cell output current is detected, and it sends to CPU407 via the interface (IF) 415.

[0065]So that CPU407 may become an input torque and the assistant motor torque computed from the assistant ratio which becomes settled in the vehicle speed etc., So that the target motor required power computed from the vehicle speed and assistant motor torque may be supplied from the motor electric circuit 404, The supply output of electric motor 21 HE is computed from the motor current detection value of the current sensor S31, and the motor electric circuit 404 is controlled to bring the difference of a target motor required power value and the supply output value of electric motor 21 HE close to 0. CPU407 controls the fuel cell controller 303 so that the cell 302 outputs a target motor required power value. That is, a fuel cell control signal is sent to the external communication part 351 of the fuel cell controller 303

from the external communication part 401 so that a difference may bring the fuel cell output voltage which is a actual output from the cell 302, the fuel cell output value computed from fuel cell output current, and a target mho evening required power value close to 0.

[0066]The fuel cell controller 303 controls the fuel valve 316 via the air pump 321 and the actuator 317 based on a fuel cell control signal and fuel cell temperature, and controls the output power of the cell 302.

[0067]Drawing 5 is a control flow chart of the control system of a hybrid type electric motor.

[0068]In [if the main switch SW is turned on, flows of control will begin, and] Step a1, A main-switch SW state is judged with the vehicle controller 400, main-switch SW state information is sent to the fuel cell controller 303, and, in OFF, it shifts to Step a2, and remaining fuel data is memorized to the nonvolatile memory 342, and, in ON, it shifts to Step a3.

[0069]In Step a3, the seizing signal of the fuel cell 30 is sent to the fuel cell controller 303 from the vehicle controller 400, the air pump 321 and the fuel valve 316 are operated, and the cell 302 is started.

[0070]In Step a4, the vehicle speed is detected from the vehicle speed pulse from the speed sensor S51 with the vehicle controller 400.

[0071]In [in Step a5, read the A/D conversion value of electric motor current, treading-in torque, cell temperature, fuel cell output current, and fuel cell output voltage, and] Step a6, When it judges whether the fuel cell 30 is [******] under starting in Step a7 when it judges whether there is any input torque of treading-in torque and there is an input torque, and the fuel cell 30 is starting, in Step a8, the vehicle speed judges that it is more than predetermined.

[0072]In Step a6, if prescribed period progress is judged and a prescribed period passes in Step a9 when there is no input torque, a fuel cell stop signal will be outputted in Step a10, and it will shift to Step a8. In Step a7, when the fuel cell 30 is not starting, in Step a11, a fuel cell seizing signal is outputted and it shifts to Step a8.

[0073]In Step a8, the vehicle speed judges that it is more than S2 predetermined, and when the vehicle speed is not more than [predetermined] S2, In Step a12, when it judges whether the fuel cell 30 is [******] under starting and the fuel cell 30 is starting, in Step a13, it is judged whether the remaining fuel reset switch S62 was pushed.

[0074]In Step a8, if prescribed period progress is judged and a prescribed period passes in Step a14 when the vehicle speed is more than [predetermined] S2, in Step a15, a fuel cell stop signal will be outputted and it will shift to Step a13. In Step a12, when the fuel cell 30 is not starting, in Step a16, a fuel cell seizing signal is outputted and it shifts to Step a13.

[0075]In Step a13, if the state of the remaining fuel reset switch S62 is judged and the remaining fuel reset switch S62 is pushed, in Step a17, fuel will be reset to 100% and fuel consumption will be computed in Step a18. In Step a13, if the remaining fuel reset switch S62 is not pushed, in Step a18, fuel consumption will be computed as it is.

[0076]accumulation consumption calculation of the efficiency map according [calculation of fuel consumption] to a cell current value, cell voltage value, and fuel consumption-production of electricity etc. to fuel -- carrying out -- remaining fuel is calculated and it expresses as the lighting number of two or more LED which installed it in the remaining fuel indicator 350 in Step a19.

[0077]In Step a20, judgment of being optimum reaction temperature and more than it is performed for cell temperature, and in Step a21, cell temperature sets an assistant ratio function as R1, and, in the case of beyond optimum reaction temperature and it, calculates the torque current of the electric motor 21 in Step a22.

[0078]In Step a20, when cell temperature is below optimum reaction temperature, in Step a23, it is set as the assistant ratio function according to cell temperature, and the torque current of the electric motor 21 is calculated in Step a22. The assistant ratio function according to cell temperature is set as R3, when temperature is low, R4 and temperature are high and R2 and temperature are middle.

[0079]It explains based on the figure showing the vehicle speed-assistant ratio of drawing 6 for calculation of this torque current, and the figures showing the treading strength torque target motor current of drawing 7.

[0080]In [the relation map of the vehicle speed-assistant ratio of drawing 6 is memorized by the memory in CPU407 of the vehicle controller 400, and take the vehicle speed along a horizontal axis, it takes an assistant ratio (tantheta) along a vertical axis, and] less than vehicle speed S2, Cell temperature is set as the assistant ratio according to optimum reaction temperature and the vehicle speed which is called for by the assistant ratio function R1 in the case of beyond it, and when cell temperature is below optimum reaction temperature, the assistant ratio function according to cell temperature is used. That is, when temperature is low, the assistant ratio function R4 and temperature are high and the assistant ratio function R2 and temperature are middle, the assistant ratio function R3 is used, and the assistant ratio according to the vehicle speed is computed and set up. According to each function, the vehicle speed approaches zero value, so that constant value and the vehicle speed increase by less than S1 and the vehicle speed increases between S1 and S2, and as for an assistant ratio, let the vehicle speed be zero value by more than S3.

[0081]It is assistant ratio =tantheta, and theta is a value of a function which becomes settled from the relation map of the vehicle speed-assistant ratio of drawing 6, and becomes settled by assistant ratio either the vehicle speed Sx or the functions which become settled in temperature conditions R1-R4.

[0082]Since the relation between assistant ratio = target motor torque / pedal torque becomes settled, target data current will multiply target motor torque by a constant and it will be asked for it if this theta value is calculated, By doubling the scale of a vertical axis (1/constant), the

figure showing the treading strength torque target motor current of drawing 7 is obtained. and a target data current value can be defined from the pedal torque value detected.

[0083]The relation map of the treading strength torque target motor current of drawing 7, Take the target motor current which drives pedal torque (treading strength torque) on a horizontal axis, and drives the electric motor 21 on a vertical axis, for example, cell temperature in drawing 6 by the case where the assistant ratio function R1 is set up in the case of beyond optimum reaction temperature and it. In the conditions of P1 at the time of vehicle speed Sx1, the line of an assistant ratio is called for in drawing 7 on the conditions of P2 at the time of vehicle speed Sx2 by the case where the line of the assistant ratio was called for in drawing 7, and the assistant ratio function R2 is set up by the case where cell temperature is below optimum reaction temperature, in drawing 6.

[0084]For example, target motor current value Iox1 for cell temperature to carry out the auxiliary drive of the wheel with the electric motor 21 in pedal torque (treading strength torque) value tx1 detected with the torque sensor S52 under run by the case beyond optimum reaction temperature and it vehicle speed Sx1 can be calculated.

[0085]Thus, in Step a24, a motor duty output is performed and the electric motor 21 is controlled to become the calculated target motor current value.

[0086]Hydrogen gas of specified pressure is added to the cell 302 of the fuel cell 30, and the fuel valve 316 comprises an opening and closing valve and pressure regulator valve.

[0087]hydrogen flow rate [of the fuel cell 30] = -- k-V-I/eta k:constant V:output voltage I:output current eta: -- it can ask at efficiency.

[0088]The fuel cell 30 drives the air pump 321 according to output current, and pneumatic pressure control is made.

[0089]The fuel cell 30 has the characteristic as shown in drawing 8. Drawing 8 is hydrogen pressure regularity, is relational data of the output current under a predetermined pneumatic pressure =f(i) function, and other outputs, voltage and efficiency, and is memorized in the memory of CPU407 as characteristic data of the fuel cell 30.

[0090]By the hydrogen flow rate type of the characteristic of the fuel cell 30 of drawing 8, and the fuel cell 30, the output current of the fuel cell 30 is supervised, and from current and voltage-characteristic-data efficiency data, fuel consumption can be computed and it can display on the remaining fuel indicator 350.

[0091]Thus, the control system of a hybrid type electric motor, The main drive system which drives the driving wheel which is the rear wheel 23 with main power, and the auxiliary power system which drives a driving wheel with the auxiliary power by the electric motor 21, The power supply which supplies electric power to the electric motor 21 and which contains the fuel cell 30 at least is carried, a power suppiy is started corresponding to change of the main drive by the main drive system, and the output of the electric motor 21 of an auxiliary power system

is controlled.

[0092]The temperature detecting means which comprises the cell temperature detection sensor S11 which detects the temperature of the fuel cell 30 in the control system of this hybrid type electric motor, It has a control means which comprises CPU407 which controls the required power of the electric motor 21 based on the temperature of a fuel cell, The temperature of the fuel cell 30 is detected and the required power of the electric motor 21 of an auxiliary power system is controlled based on the temperature of the fuel cell 30, That is, it is possible to combine electromotive force effectively corresponding to the operational status of a hybrid type electric motor, and to operate a fuel cell effectively by controlling to send the target data current corresponding to fuel cell temperature and the vehicle speed through the electric motor 21.

[0093]By a control means's controlling the required power of the electric motor 21 not to make the electric power more than permission output from the fuel cell 30, when the temperature of the fuel cell 30 is below prescribed temperature, and suppressing the output at the time of the low temperature of the fuel cell 30, Degradation of the fuel cell 30 can be prevented and fuel consumption efficiency can be raised.

[0094]The operational state detecting means which comprises the speed sensor S51 which detects the operational status of a hybrid type electric motor in the control system of a hybrid type electric motor, It has a control means which comprises CPU407 which controls the required power of the electric motor 21 based on operational status, Detect the operational status of a hybrid type electric motor, and the required power of the electric motor 21 of an auxiliary power system is controlled based on operational status, For example, unnecessary power consumption, such as stopping the fuel cell 30 for fuel economy for the reason for the legal restrictions which do not carry out electric assistance above the state which does not need electric assistance, such as waiting for a signal and a long downward slope, or regulation speed, can be prevented, and it becomes saving of the fuel of the fuel cell 30.

[0095]The output power detection means which comprises the voltage sensor S13 which detects the output power of the fuel cell 30, and the current sensor S12 in the control system of a hybrid type electric motor, The control means which comprises CPU407 which computes fuel consumption from the current, voltage characteristic data, and efficiency data which were beforehand memorized based on output power, It has a remaining fuel displaying means which comprises calculation of this fuel consumption with the remaining fuel indicator 350 and the display 71 which display remaining fuel, Detect the output power of the fuel cell 30 and fuel consumption is computed from the current, voltage characteristic data, and efficiency data which were beforehand memorized based on this output power, Remaining fuel is displayed from calculation of this fuel consumption, and an improvement of weight and cost can be aimed at by detecting remaining fuel by calculation without using the flow instrument for

detecting remaining fuel.

[0096]Although it has the auxiliary battery 340 which is a cell (capacity smallness) as the auxiliary power 409 and a power supply for fuel cell actuating which is a CPU power supply in this embodiment, When there is no cell for auxiliary power (capacity is large), the fuel cell 30 regulates the generating capacity of the fuel cell 30 corresponding to time short ** from the degree of low temperature, or an activation start, etc., and the rate (assistant ratio) of electromotive force over human power is lowered.

[0097]When it has the auxiliary battery 340 which is a cell as the auxiliary power 409 and a power supply for fuel cell actuating which is a CPU power supply, and a cell for ********* (capacity is large), The fuel cell 30 regulates the generating capacity of the fuel cell 30 corresponding to time short ** from the degree of low temperature, or an activation start, etc., however the rate of electromotive force over human power is not changed. However, an assistant ratio is lowered when the amount of residual battery capacities is small. Even when this amount of residual battery capacities is small, the fuel cell 30 makes an assistant ratio a steady-state value without regulating [in / from temperature or an activation start / time etc.] the generating capacity of 30 besides ****** enough.

[0098]Although it has the auxiliary battery 340 which is a cell (capacity smallness) as the auxiliary power 409 and a power supply for fuel cell actuating which is a CPU power supply, When there is no cell for auxiliary power (capacity is large), the fuel cell 30 controls the generating capacity of the fuel cell 30 enough enough corresponding to [cases, such as time,] the human power of the main drive system from temperature or an activation start. Since change is large, human power controls the generating capacity of the fuel cell 30 corresponding to the average treading strength for the number stroke of steps (human power torque). The amount of treading strength (human power torque) change can arrange the cell or capacitor of small capacity, it can be operated as a buffer of charge and discharge, and can maintain an assistant ratio to a predetermined value as a result. However, the speed sensor S51 is formed, according to the vehicle speed, vehicle speed Hirotoki lowers the predetermined value of an assistant ratio, when the vehicle speed is slow, the predetermined value of an assistant ratio is raised, and the fuel cell 30 is controlled so that the generating capacity which multiplied human power by this predetermined value is acquired.

[0099]The generating capacity of the fuel cell 30, The amount of output current or output cell from an output controlling circuit arranged in the middle of. [the output circuit of the air pump 321 which are the amount-of-supply control actuator 317 of fuel (hydrogen gas or methanol (liquid or gas)), and an amount-of-supply control actuator of oxygen or the fuel cell 30] It carries out by controlling the variable circuit characteristic element of an output controlling circuit so that it may be made to agree with a desired value.

[0100]Although the remaining fuel indicator 350 provided in the cartridge 300 which is the

display 71 and container which were formed in the bicycle side (center section of the right-and-left handle) about remaining fuel is arranged, a display may be arranged to the tank side. The power generation information of the fuel cell 30 and assistant ratio information are also displayed on the bicycle side (a lamp, a buzzer, LED, or liquid crystal display).

[0101]In the embodiment of the above-mentioned hybrid type electric motor, the assistant ratio calculated from the vehicle speed of the assistant functions R1-R4 chosen by the cell temperature of the fuel cell 30 is set to 1.0 at the maximum. That is, although the hybrid type electric motor which carries the fuel cell 30 as a power supply was the bicycle 1 with electric assistance which makes auxiliary power the motor output which makes the input used as the 1st power main power, and turns into the 2nd power, it is good also not only considering this embodiment but an assistant ratio as 0-3.0. Human power which becomes 1.0 or more, i.e., the 1st power, about an assistant ratio in every vehicle speed is made into auxiliary power, it is considered as the battery-assisted bicycle which makes the motor output used as the 2nd power the main auxiliary power, and the maximum assistant ratio is also good also as 10-20 depending on the case. In this case, the pedal 14 serves as an accelerator device for the output adjustments of the electric motor 21 which is main power rather than calling it an auxiliary power grant means.

[0102]One-way rotation KURATTE which permits only the transmitting power of the direction of the crankshaft 12 for the transmitting power course from the pedal 14 to the crankshaft 12 may be arranged. Even if it does not row the pedal 14, unless an unillustrated brake is made to act, it can be made to run with constant speed or a regularity electric output before stopping the pedal 14 with the output of the electric motor 21. While applying mechanical braking power to the front wheel 8 or the rear wheel 23 at the time of a brake action, the electric power supply to the electric motor 21 is stopped.

[0103]In the battery-assisted bicycle which makes human power main power or auxiliary power, it is still better also as a run only by human power being possible to arrange a clutch for the transmitting power course from the electric motor 21 to the crankshaft 12, or arrange electric motor 21 safety switch. In this case, loads, such as frictional force of the electric motor 21, can reduce the part which becomes small or the part whose generating load by the electric motor 21 generating electromotive force is lost, and treading strength.

[0104]Further, simultaneous or individually, in the hybrid type battery-assisted bicycle which can act on a driving wheel, although he is trying to transmit the output of the electric motor 21 to the rear wheel 23 via the chain which is a power transmission device of human power, the human power and electromotive force of each of said embodiment, it may be made to drive the direct front wheel 8 or the rear wheel 23 via a chain. Also in this case, a clutch may be arranged for the transmitting power course from the electric mho evening 21 to front "* 8 or the rear wheel 23.

[0105]As a hybrid type battery-assisted bicycle, four wheel vehicles not only like the above-mentioned two-wheeled vehicle but an electric wheelchair may be used. addition of a direct entry being enabled in an electric wheelchair at the rear wheel of a major diameter, and connecting with a rear wheel -- ** -- even if small, a hybrid run with the electromotive force of an electric motor and human power which are made into one fuel cell of a power supply is enabled.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a side view of a hybrid type electric motor.
[Drawing 2]It is a figure showing the state where the power supply of the hybrid type electric motor was removed.
[Drawing 3]It is a block diagram showing the composition of a fuel cell.
[Drawing 4]It is a block diagram of the control system of a hybrid type electric motor.
[Drawing 5]It is a control flow chart of the control system of a hybrid type electric motor.
[Drawing 6]It is a figure showing a vehicle speed-assistant ratio.
[Drawing 7]It is a figure showing treading strength torque target motor current.
[Drawing 8]It is a figure showing the characteristic of a fuel cell.
[Description of Notations]
1 A bicycle with electric assistance
12 Crankshaft
21 Electric motor
30 Fuel cell
300 Cartridge
301 Fuel tank
302 Cell
303 Fuel cell controller
400 Vehicle controller
404 Motor drive circuit
407 CPU

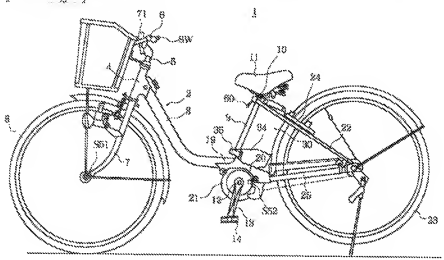
[Translation done.]

* NOTICES *

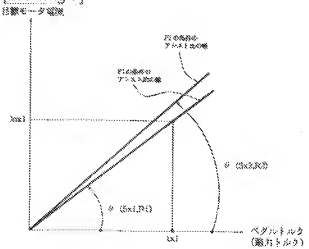
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

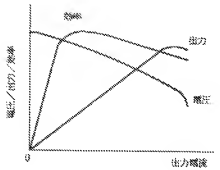
[Drawing 1]



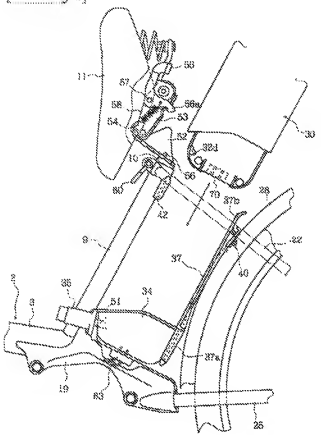
[Drawing 7]



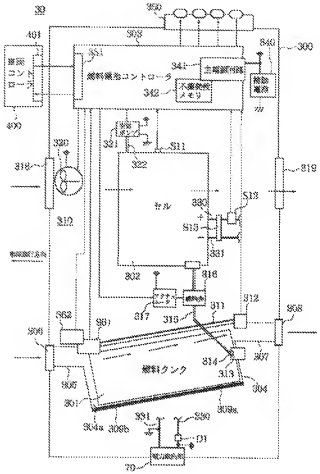
[Drawing 8]



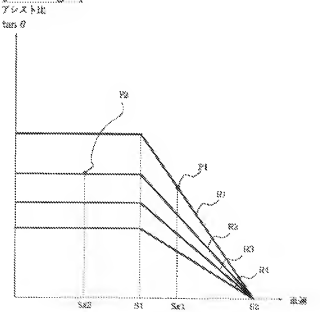
[Drawing 2]



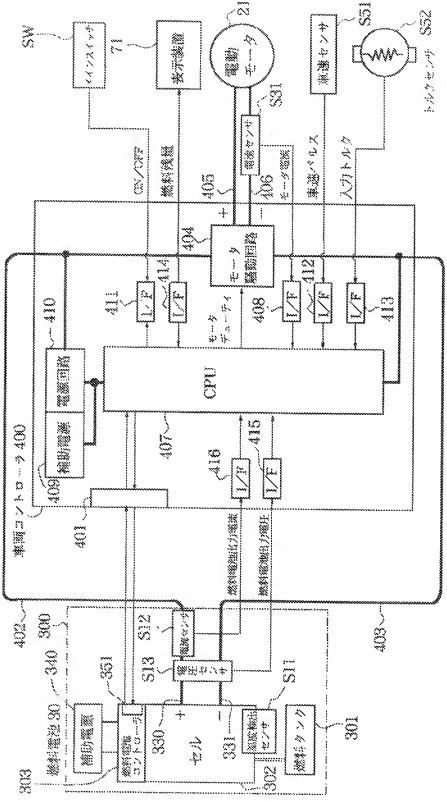
[Drawing 3]



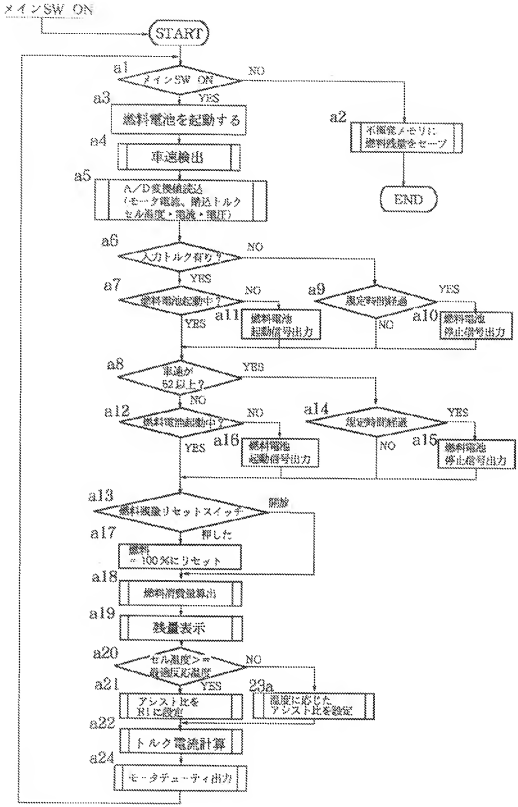
[Drawing 6]



[Drawing 4]


SW
イグニッション
71
表示装置
21
電動モータ
S31
電流センサ
車速センサ
S51
S52
トルクセンサ
ON/OFF
燃料残量
405
406
モータ電流
車速パルス
入力トルク
車両コントロール400
410
電源回路
補助電源
409
401
CPU
407
416
415
L/F
411
414
412
413
408
モータ駆動回路
404
モータデューティ
燃料電池出力電圧
燃料電池出力電流
402
403
300
340
351
S13
S12
S11
電圧センサ
電流センサ
燃料電池30
補助電源
燃料電池コントローラ
330
331
セル
温度検出センサ
302
燃料タンク
301

[Drawing 5]



[Translation done.]